**ADDITIONAL FEES:**

A check in the amount of $304.00 is enclosed to cover the cost of two additional independent claims in excess of those already paid for and eight claims in excess of twenty total. Should the check prove insufficient for any reason, or should it be determined that an additional fee is due, authorization is hereby given to charge any such deficiency or additional fee to our Deposit Account No. 01-0268.

**REMARKS**

To place this application in better condition for complete action on the merits, the specification has been suitably revised to correct informalities and to bring it into better conformance with U.S. practice. Claims 1-12 have been amended in formal respects to improve the wording and to bring them into better conformance with U.S. practice. No narrowing amendments have been made to any of the claims.

Submitted herewith is an attachment entitled **"VERSION WITH MARKINGS TO SHOW CHANGES MADE"** containing a marked-up copy showing the changes to the specification and claims 1-12.

To obtain a fuller scope of coverage, new claims 13-28 have been added. Adequate support for the subject matter recited in these claims may be found in the specification as originally filed.

Early and favorable action on the merits are most respectfully requested.

Respectfully submitted,

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**MAILING CERTIFICATE**

I hereby certify that this correspondence is being deposited with the United States Postal Service as first-class mail in an envelope addressed to: Commissioner of Patents & Trademarks, Washington, D.C. 20231, on the date indicated below.

Bruce L. Adams
Attorney Name

_____
Signature

SEPTEMBER 10, 2001
Date

"VERSION WITH MARKINGS TO SHOW CHANGES MADE"

IN THE SPECIFICATION:

**Paragraph beginning at line 8 of page 5 has been amended as follows:**

As discussed above, the information recorded by the magneto-optical recording scheme is due to determination of a light polarization state of a reflected or transmitted portion of the applied light and requires the device to pass the reflection or transmission light to a photodetector. The loss of light in that case is large. Near-field light in nature possesses [merely] an extremely low intensity. It is therefore difficult to employ a magneto-optical recording scheme in an optical memory information reproducing method utilizing near-field light. At the same time, also difficult is its adoption as an optical memory information recording method.

**Paragraph beginning at line 15 of page 7 has been amended as follows:**

An information recording apparatus according to one aspect of the present invention comprises [is characterized by comprising:] a probe for producing or scattering near field light[; a], probe access means for causing a tip of the probe

to access [onto] a recording medium[; a] a probe scanning means for scanning the tip of [aid] the probe over the recording medium[;], and [a] heat radiating means for radiating heat through the tip of the probe[;], wherein the recording medium is provided on the surface with a thin film that varies in physical properties [due] in response to heating the surface.

**Paragraph beginning at line 19 of page 9 has been amended as follows:**

Also, an information recording apparatus according to another aspect of the invention comprises [is characterized by comprising:] a probe for producing or scattering near field light[; a], probe access means for causing a tip of the probe to access [onto] a recording medium[; a], probe scanning means for scanning the tip of [aid] the probe over the recording medium[; a], heat radiating means for radiating heat through the tip of the probe[;], and [an] auxiliary heat radiating means to heat up the recording medium[;], wherein the recording medium is provided on the surface with a thin film that varies in physical properties [due] in response to heating the surface.

**Paragraph beginning at line 5 of page 10 has been amended as follows:**

Accordingly, in addition to heat energy offered from the probe tip, the auxiliary heat radiating means is provided to heat a microscopic region on a recording medium thus enabling information recording more positively and higher in reliability.

**Paragraph beginning at line 10 of page 10 has been amended as follows:**

[Also, an] An information recording apparatus according to another aspect of the invention [is characterized by comprising:] comprises a probe having a sharpened tip[; a], probe access means for causing the tip of the probe to access [onto] a recording medium[; a], probe scanning means for scanning the tip of the probe over the recording medium[;], and an illumination light source for illuminating a backside of the recording medium and producing near field light on a surface of the recording medium[;], wherein the recording medium is provided at the surface with a thin film that varies in physical properties [due] in response to heating the surface.

**Paragraph beginning at line 6 of page 11 has been amended as follows:**

Also, an information recording apparatus according to the invention is characterized in that the illumination light source illuminates the surface of the recording medium and [producing] produces near field light on the surface of the recording medium.

**Paragraph beginning at line 11 of page 11 has been amended as follows:**

Accordingly, because near filed light is produced on the surface of a recording medium by illuminating the surface of the recording medium as a recording surface, high density recording of information can be [recorded] achieved without transmission of illumination light through the recording medium, i.e. even onto an opaque recording medium for illumination light.

**Paragraph beginning at line 18 of page 11 has been amended as follows:**

A method of recording information according to one aspect of the invention comprises [is characterized] [by comprising:] a probe access process of causing a tip of a probe for producing or scattering near field light to access

[onto] a recording medium[;]⊥ a probe scanning process of scanning the tip of the probe to a desired position on the recording medium[;]⊥ and a heat recording process of radiating heat energy through the tip of the probe [to] <u>for</u> locally heating up the recording medium and recording information on the recording medium.

**Paragraph beginning at line 10 of page 12 has been amended as follows:**

Accordingly, in addition to the heat energy offered through the probe tip, the auxiliary heating process is provided [to] <u>for</u> further heating the region where the heat energy is applied. Thus, heating is possible more positively in a sufficient size, enabling high density recording of information with reliability.

**Paragraph beginning at line 16 of page 12 has been amended as follows:**

Furthermore, a method of recording information <u>according to another aspect of the invention comprises</u> [is] [characterized by comprising:] an illumination process of illuminating the surface of a recording medium and producing near field light on the recording medium[;]⊥ a probe access process of causing a sharpened tip of a probe to access [onto]

the recording medium and recording information on the recording medium by locally intensified energy caused due to insertion of the tip of the probe in a region of the near field light[;], and a probe scanning process of scanning the tip of the probe to a desired position on the recording medium.

**Paragraph beginning at line 12 of page 13 has been amended as follows:**

Furthermore, a method of recording information according to the invention is characterized in that the illumination process is performed to illuminate a backside of the recording medium and [producing] produce near field light on the recording medium.

**Paragraph beginning at line 22 of page 15 has been amended as follows:**

Hereunder, embodiments of information recording apparatuses according to the present invention will be explained in detail based on the attached drawings.

**Paragraph beginning at line 24 of page 18 has been amended as follows:**

Incidentally, the above explanation used, as a recording probe, the optical probe having the microscopic

aperture is used. Alternatively, this may be replaced by a conventional micro-cantilever used in an AFM so that the laser light given off by the heater light source 4 is applied to the micro-cantilever to heat up the micro-cantilever itself thereby providing the heat energy radiated at a tip of the micro-cantilever to the recording medium 3. The tip of the micro-cantilever is generally finer than a diameter of the microscopic aperture possessed by the above optical probe, through which heat energy is radiated and localized to nearly a tip size. It is therefore possible to record information with high density surpassing a recording density of the conventional optical memory recording apparatus.

**Paragraph beginning at line 20 of page 20 has been amended as follows:**

Furthermore, the micro-cantilever itself may be formed as a heater element so that the heater element 13 and the heat conductive layer 14 may be eliminated.

**Paragraph beginning at line 4 of page 21 has been amended as follows:**

In Fig. 7, an optical fiber probe 21 is adopted as a recording probe having, at a tip thereof, a not-shown microscopic aperture to which light given off by a heater light source 4, preferably coherent laser light, is introduced

through a condensing optical system 6. The microscopic aperture of the optical fiber probe 21 herein has a diameter sufficiently smaller than a wavelength of laser light to be introduced, e.g. in a size of nearly several tens nano-meters. Furthermore, the optical fiber probe 21 is in an L form directed toward the surface of a recording medium 3. Because the handling ability of this probe is like that of [of handlability alike] a conventional AFM cantilever, it is convenient to utilize [in utilizing] [an] the AFM technology.

**Paragraph beginning at line 17 of page 21 has been amended as follows:**

The microscopic aperture of the optical fiber probe 21 when introduced with laser light causes near-field light at its microscopic aperture part. Also, the optical fiber probe 21 is caused to access the recording medium such that the surface of the recording medium 3 is included in a near-field light region at the microscopic aperture part by the conventional AFM technology, that is, the probe displacement detector mechanism 7 and the feedback mechanism 9.

**Paragraph beginning at line 15 of page 25 has been amended as follows:**

Accordingly, light, preferably coherent laser light, is locally applied, at a backside of the recording medium 3,

to a point at which [having] the microscopic aperture of the optical fiber probe 21 is located. This assists [to heat] in heating up the phase change film area where the microscopic aperture is located. In Fig. 7, the laser light from an assist light source 22 is applied through an optical system formed by a mirror 23 and condensing optical system 24 to the backside of the recording medium 3, thereby giving assistance [to] in locally heating-up the recording medium 3.

**Paragraph beginning at line 25 of page 22 has been amended as follows:**

This complements the probe 21 and overcomes the insufficiency [of] in thermal energy [in] needed for [reaching of] elevating the phase change film to the phase shift temperature [as] encountered where providing only heat energy due to the near-field light produced at the microscopic aperture [part] of the probe 21. Thus, high density of information recording is achieved on the phase change film formed on the recording medium 3. Incidentally, it is preferred to making the amount of heating by near-field light, or the intensity of laser light for causing near-field light, to as small as possible with respect to the amount of heating by the assist light source, or the intensity of laser light at the assist light source. This makes it possible to reduce the

intensity of laser light to be introduced to the optical fiber probe 21, preventing the microscopic aperture part from being deformed or damaged due to laser-light heating. Furthermore, because the optical system for the assist light source is arranged on a back side of the recording medium, the recording medium in its surface is to be effectively utilized.

**Paragraph beginning at line 21 of page 24 has been amended as follows:**

Incidentally, in Embodiments 1 and 2 described above, the information recorded on the recording medium can be reproduced, for example, by a near-field light detection technology for the near-field microscope, i.e. a method that near-field light localized on a recording medium is scattered into scattered light to be [detect] detected intensity change or phase change.

**Paragraph beginning at line 7 of page 25 has been amended as follows:**

In Fig. 10, a recording probe 26 has a sharpened tip, e.g. a micro-cantilever for use in AFM or a probe used in an STM (Scanning Tunnel Microscope). In particular, a metal probe is preferred. Meanwhile, a recording medium 3 is formed, for example, with a phase change film for use in a

phase change scheme as was explained in Embodiment 1.

**Paragraph beginning at line 20 of page 25 has been amended as follows:**

The recording probe 26 at its tip is inserted in a region of near-field light localized on the surface of the recording medium 3 and caused to access a desired point on the recording medium 3. This causes the near-field light 29 to scatter at the tip of the recording probe 26, producing scattered light (propagation light). This propagation light has energy having an intensity distribution greater in a vicinity of the tip of the recording probe 26. Due to this, an intensified energy region 30 is caused <u>to overlap</u> [overlapped] with the energy given off by the localized near-field light 29 in a desired point on the recording medium 3 accessed by the tip of the recording probe 26. The intensified energy region 30 provides [to] the phase change film with heating reaching a phase shift temperature in a desired point on the recording medium 3 as could not be attained by the energy of only <u>a</u> near-field light. Thus, high density [of] information recording is made possible on the recording medium 3.

**Paragraph beginning at line 15 of page 26 has been amended as follows:**

To reproduce the information recorded by the intensified energy region 30, laser light 28 comparatively weak in intensity is applied to the backside of the recording medium 3 such that the intensified energy region 30 in the information recording as mentioned above has [such] an intensity <u>such</u> that the phase change film is not <u>raised</u> to [reach] the phase shift temperature. The laser light 28 comparatively weak in intensity produces near-field light 29 having similarly comparatively weak intensity. The recording probe 26 at the tip is inserted in a region of the produced near-field light 29 to scatter the near-field light 29, thereby obtaining scattered light (propagation light) 31. The obtained propagation light 31 is guided to not-shown photodetector by the focusing optical system 27. Accordingly, a recording state of information is determined in a point on the recording medium 3 accessed by the tip of the recording probe, from an intensity or phase of the propagation light 31. Thus, the reproducing of the information recorded on the recording medium 3 is achieved.

**Paragraph beginning at line 16 of page 28 has been amended as follows:**

Incidentally, the above recording control of information uses the feedback mechanism 9 capable of controlling the position of the cantilever type optical probe 25 in a Z direction. In a recording point, the cantilever type optical probe 35 at its tip is caused to access very closely to [an] a surface of the recording medium 3 thus carrying out recording. In a non-recording point, the cantilever type optical probe 35 is put lifted.

**IN THE CLAIMS:**

**Claims 1-12 have been amended as follows:**

1. (Amended) An information recording apparatus comprising:

a probe for producing or scattering near field light;

[a] probe access means for causing a tip of the probe to access a desired region of [onto] a recording medium;

[a] probe scanning means for scanning the tip of the probe [over] across a surface of the recording medium; and

[a] heat radiating means for radiating heat through the tip of the probe;

wherein the surface of the recording medium is provided [on the surface] with a thin film that varies in physical properties in response [due] to heating of the surface by the tip of the probe.

2. (Amended) An information recording apparatus according to claim 1; [,] wherein the heat radiating means comprises [is] an electric heating element for heating the tip of the probe.

3. (Amended) An information recording apparatus according to claim 1; [,] wherein the heat radiating means comprises [is] a laser light source for projecting laser light through the tip of the probe.

4. (Amended) An information recording apparatus according to claim 3; [,] wherein the probe has [is provided with] a microscopic aperture at the [a] tip thereof, and [so that laser light from] the laser light source introduces light through [can be introduced toward] the microscopic aperture.

5. (Amended) An information recording apparatus according to claim 4; [5,] wherein the tip of the probe [microscopic aperture] has [is provided with] a metal film formed on a [the] surface thereof [of the probe] except for the microscopic aperture [tip thereof].

6. (Amended) An information recording apparatus according to any one of claims 1 to 5; [,] further comprising [including] auxiliary heat radiating means for heating [to heat up] the recording medium without radiating heat through the tip of the probe.

7. (Amended) An information recording means comprising:

a probe having a sharpened tip;

[a] probe access means for causing the tip of the probe to access a desired region of [onto] a recording medium;

[a] probe scanning means for scanning the tip of the probe [over] across a first surface of the recording medium; and

an illumination light source for illuminating a second surface [backside] of the recording medium opposite the first surface so that a [and producing] near field light is produced above [on] the first surface of the recording medium;

wherein the first surface of the recording medium is provided [on the surface] with a thin film that varies in physical properties in response [due] to heating of the surface.

8. (Amended) An information recording apparatus according to claim 7; [,] wherein the illumination light

source further illuminates the first surface of the recording medium to produce a [and producing] near field light above [on] the first surface of the recording medium.

9. (Amended) A method of recording information comprising:

a probe access process of causing a tip of a probe [for producing or scattering near field light] to access [onto] a recording medium to produce or scatter near field light;

a probe scanning process of scanning the tip of the probe to a desired position on the recording medium; and

a heat recording process of radiating heat energy through the tip of the probe to locally heat [heating up] the recording medium to record [and recording] information at the desired position on the recording medium.

10. (Amended) A method of recording information according to claim 9; [,] further comprising an auxiliary heating process of locally [auxiliary] heating the recording medium using an auxiliary heating device that does not radiate heat energy through the tip of the probe.

11. (Amended) A method of recording information including:

an illumination process of illuminating a desired position of a [the] surface of a recording medium to produce [and producing] near field light above [on] the surface of the recording medium at the desired position;

a probe access process of causing a sharpened tip of a probe to access [onto] the desired position of the recording medium to record [and recording] information on the recording medium by locally intensified energy caused by [due to] insertion of the tip of the probe in [a region of] the near field light at the desired position; and

a probe scanning process of scanning the tip of the probe across the surface of the recording medium to the [a] desired position on the recording medium to record the information.

12. (Amended) A method of recording information according to claim 11; [,] wherein the illumination process comprises a process of illuminating [is to illuminate] a surface [backside] of the recording medium opposite a surface to which the sharpened tip of the probe is accessed so as to produce [and producing] near field light on the surface of the recording medium accessed by the sharpened tip.